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United States Department of Agriculture.

DIVISION OF BOTANY.

THE RUSSIAN THISTLE.

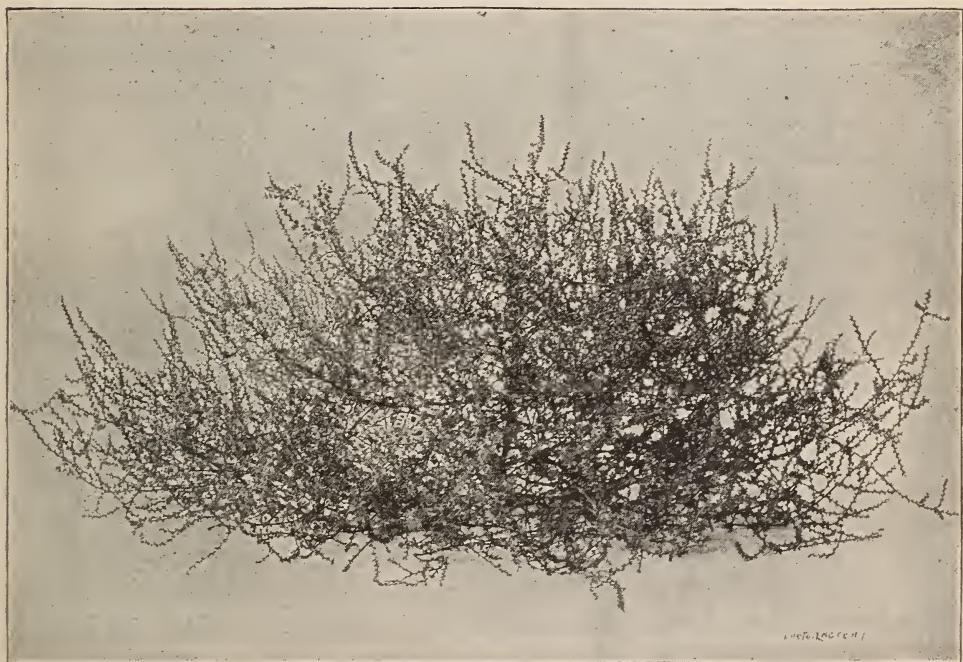


FIG. 1.—Mature Russian Thistle.

The plant now famous under the name “Russian thistle” is undoubtedly of Russian origin, having been accidentally introduced into South Dakota in flaxseed in 1873. It is not, however, a thistle, nor does it resemble one, except in its spines and noxious character. In its rolling habit it is like the common tumbleweed of the plains. Properly it is a vicious inland variety of the saltwort, a nearly harmless plant abounding on our Atlantic seacoast.

DESCRIPTION.

The seeds of the weed germinate in April, May, and June, each sending up on a slender stalk two narrow green leaves about an inch long, somewhat similar in appearance to blades of grass. Between these seed leaves a short stem soon appears, bearing slender, sharp-pointed leaves, presently with branches in their axils (fig. 2, *b*). Until dry weather begins the herbage is tender and juicy, and is eagerly eaten by sheep, cattle, and horses. During this stage the growth is rather slow. With the advent of dry weather in July and August the moisture disappears from the leaves, and they wither and sometimes fall off. New shoots are rapidly formed, which at first are densely crowded with spine-pointed leaves less than half an inch long, but later elongate, so that the leaves become separated by intervals of one-sixteenth to one-half an inch (fig. 2 *a*).

Each leaf is accompanied by bracts similar to the leaf itself, all spine-tipped and projecting almost at right angles to the stem. A single small stemless flower grows in a cup-shaped depression formed by the bases of the two bracts. The outer parts, or perianth, of the flower are thin and paper-like in texture, usually bright rose-colored, and spreading, when fully open, about one-fourth of an inch (fig. 2, *d*). If the flower is taken out and carefully pulled to pieces a small pulpy, green, coiled body, appearing like a minute snail shell, will be found (fig. 2, *f*). This is the embryo or miniature plant. As the seed ripens its coat becomes of a dull gray color, and at maturity the whole seed is about one-sixteenth of an inch in diameter, irregular in form, and of about one-half the weight of a flax or clover seed (fig. 2, *e*).

During August and early September the plants become rigid throughout and increase rapidly in size, forming a dense, bushy mass of spiny branches, often 2 or 3 feet in height and 4 to 6 feet in diameter (fig. 1 and fig. 2, *a*). By the middle of September the exposed parts of the plants have usually changed color from dark green to crimson or rose-red. When the ground is frozen in November the entire plant, except the seed, dies.

The root, one-half inch or less in diameter, is now broken off at the surface of the ground by the force of the wind, and the plant is blown about as a tumbleweed, scattering seed wherever it goes. The seed remains inclosed in the paper-like perianth, and, together with this, is loosely held in its place by numerous twisted hairs, so that it is not readily shaken loose from the plant (fig. 2, *c*). A plant may therefore roll about all winter and still retain some of its seeds until the following spring. When the seed breaks loose from the plant the dry flower-parts surrounding it act as a sail, so that it may be carried a long distance over the snow independently of the rolling plant. The seeds alone will not be borne through the air like thistle down except in the case of very high winds, and they will not in any case be blown very far over the bare ground.

A single plant of average size, 2 to 3 feet in diameter, and weighing 2 to 3 pounds at maturity when dry, is estimated to bear 20,000 to

30,000 seeds. Single plants have been found 6 feet in diameter, weighing about 20 pounds when thoroughly dry, and estimated to bear 200,000 seeds. At maturity the heaviest and strongest parts of the plants are the seed-bearing twigs. The inner branches receive little of the wear incident to tumbling about, and are only strong enough to hold the plant together.

The two common tumbleweeds of the plains (*Amaranthus albus* and *Cycloloma atriplicifolia*) are the plants most likely to be mistaken for the Russian thistle. They have the same hemispherical form and bushy habit, but they can readily be distinguished by their flat leaves and by the absence of spines; and, besides this, they begin to roll a month earlier than the Russian thistle.

FIG. 2.—Detailed figures of the Russian thistle: *a*, branch of the mature plant; *b*, seedling about two weeks after germination; *c*, flower detached from the axil and remaining suspended by minute hairs; *d*, flower viewed from above and in front, showing the cone-like connivent calyx lobes in the center and the membranaceous spreading wings; *e*, seed with flower parts removed, enlarged; *f*, embryo removed from the seed, enlarged.

land, crowding out other plants. Flax, wheat, rye, barley, and oats all suffer from its effects, not only in the reduction of the crop, but in the lower grade of that which is harvested. Corn, potatoes, vegetables, and in fact nearly all cultivated crops, are injured more or less, proportionately to their lack of care and cultivation.

The spiny character, added to the rigid, bushy habit of the plant, makes it one of the most disagreeable of weeds to handle. When mature it can not be plowed under, and it is often impossible to plow fields at all until the thistles are removed. Binders can not be run where the thistles are abundant, and even the working of the headers is seriously interfered with. The annoyance and positive injury to men and animals which they cause by their rigid spines is undoubtedly greater than that caused by any of the true thistles. A trouble of another kind results from their being blown during prairie fires across fire-breaks that would otherwise be ample protection to stacks or buildings.

TROUBLESONE CHARACTER.

The injury to crops is of course the most important item in the damage caused by the Russian thistle. It takes complete possession of the



USEFUL QUALITIES.

When the Russian thistle plants are young and tender they are of some use as green forage for stock, especially sheep. During the past season (1894) a large amount of Russian-thistle hay has been cut and cured to supplement the shortage in the regular hay crop caused by drought. The plants were cut for this purpose in July or early in August, before they had become rigid and before the spines had formed sufficiently to cause trouble in handling or to prevent stock from eating them. The reports so far received in regard to both the pasturage and the hay formed by this plant indicate that it is of fair quality and really of considerable value as a kind of "famine crop" for use in the absence of grasses and other forage of better quality. It has sometimes been plowed under in July for green fertilizer, and the statement has been made, though evidently without careful experiments, that it is equal to clover for this purpose. Recent chemical analyses¹ give it a food value comparable with that of clover, but in the absence of carefully conducted feeding experiments this is quite indecisive.

Some weight should be given to the fact that the Russian thistle belongs to a class of plants none of which have ever been found to be valuable for forage except in desert regions. Its roots are too short to bring up plant food from the subsoil, and there is an entire lack of any indication that it draws its nitrogen from the air and stores it in a form available for other plants, which are the essential characters of plants suitable for green fertilizing. Like other weeds, or vegetation of any kind, plowed under, it will add some humus to the soil, and it is certainly much better for it to be thus utilized than to be allowed to blow away. Wherever the Russian thistle has been introduced, the above methods of making use of it should by all means be taken advantage of, as they are among the best methods of eradication and at the same time afford some direct compensation for the work entailed.

RAPID SPREAD AND PRESENT DISTRIBUTION.

During the twenty-one years since its introduction into this country it has spread with greater rapidity than any other weed. Ninety new localities have been reported to the Department of Agriculture during the present season (1894). It now occurs in places from eastern Ontario and western New York to the western border of Idaho, and from Manitoba to southern Colorado, being most abundant in South Dakota and adjacent States. Sixteen States and three Canadian provinces are known to be infested, and, although not reported, it is probably present in Missouri, Oregon, and Washington.²

¹Bulletin No. 26 Experiment Station, Ames, Iowa. Bulletin No. 34, Experiment Station, St. Anthony Park, Minn.

²It has been reported from Wyoming and New York since the plate for the accompanying map was made.

Warning to Pacific coast wheat growers.—East of the Rocky Mountains the thistle is already so widely distributed that its continued progress in that region is inevitable. Its advent in Idaho, however, is a far more serious matter. The Rocky Mountains present a great natural barrier which the thistle will not easily pass, except by artificial conveyance. With the natural conditions thus favorable to its exclusion and with a full knowledge of the disastrous nature of the scourge, it is almost criminal to allow it to become established west of the Rockies.

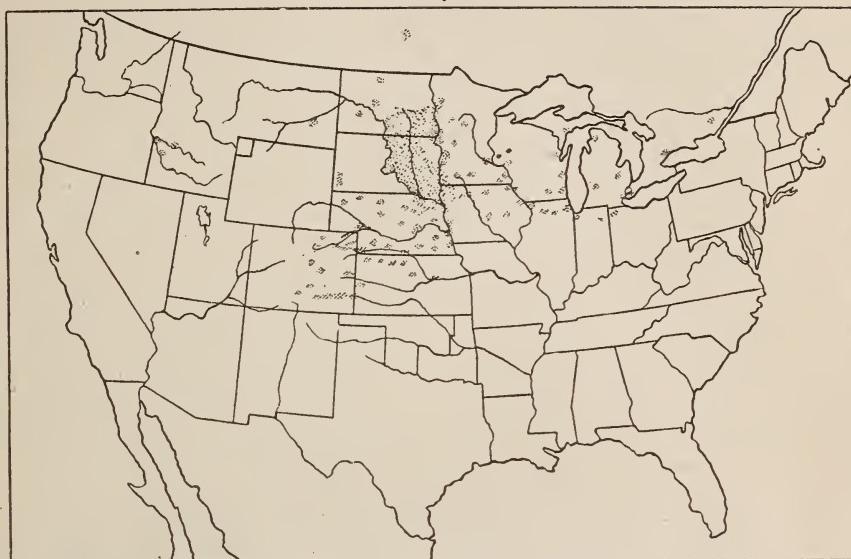


FIG. 3.—Distribution of the Russian thistle in the United States and Canada, so far as known in October, 1894.

To the Pacific Coast the Sierra Nevada and Cascade mountains afford additional protection, but some seed will be sure to find its way over this barrier also, especially if the thistle is allowed to obtain a hold in the Great Basin. In view of these facts the California wheat-grower should take precautions against the weed, opposing both its direct introduction into California from the plains east of the Rockies and its gradual advance by way of the Great Basin.

REMÉDIES.

The plant is an annual, easily killed at any time during the growing season; it produces no seed before the middle of August or first of September, and the seed is short-lived. The circumstances, therefore, are exceptionally favorable for its being checked or even exterminated. In order to secure a complete extirpation, these two conditions must be fulfilled:

1. No Russian thistles shall be allowed to produce seed.
2. There must be concerted action throughout all the infested area.

If the Russian thistle, wherever found, should be killed before it produces seed, during three successive years, the pest would in all

probability be completely exterminated; for the experiments already made indicate that the vitality of the seed is lost within that period. But since the ground is so easily reseeded from a neighboring crop, if action is not taken everywhere and at one time the work will have to be done over indefinitely.

In the absence of universal concerted action, as extensive coöperation as possible should be secured; and, at all events, each farmer should protect his own farm as well as he may, in doing which he will also avoid injuring his neighbor. The want of coöperation is a great disadvantage. Farmers in some instances have so far succeeded in keeping the weed under that their crops have been little injured, but it has cost a great deal in extra labor, and they have been compelled to fight it every year because of seed blown in from adjacent lands. On the other hand, the farmer who has not attempted to drive the weed from his farm has sustained immense damage to his crops, and in some cases has even been driven from his farm.

Remedies in cultivated fields.—Wheat and other spring crops should be sowed as early as possible on well-prepared land, so that the crop may get a vigorous start and shade the ground before the weed seeds germinate. The wheat may then be cut early, when there is less danger that the thistle plants will be large enough to cause trouble in harvesting. By such a plan, this and many other weeds growing in the stubble may be destroyed before they produce seed.

The land should be plowed as soon as possible after the wheat is cut, and if this can not be done before the first of September the stubble should be burned. The thistle is still rather juicy in August and burns with difficulty, so that it is advisable to mow the stubble and let it dry a few days before firing. In this connection the importance of harvesting with a header is to be emphasized, as the greater amount of stubble left by this process furnishes material for a more thorough burning. The land should be plowed or the stubble burned immediately after harvesting a crop of barley, rye, or oats.

Crops like corn, potatoes, and beets should be kept thoroughly cultivated as late as possible. The extra cultivation will produce a better crop as well as kill the weeds. Several cornfields seen in the fall of 1893 evidently produced a much better crop of Russian thistles and pigeon grass than of corn, while other fields near by, apparently with the same kind of soil, but free from pigeon grass and the Russian thistle, bore a corn crop 50 per cent better. Such crops should be cultivated until they thoroughly shade the ground, and if thistles appear after that, the hoe should be used, so that none may be allowed to produce seed. Potato fields and gardens devoted to early crops should receive better attention than heretofore. When cultivated only enough to produce a crop and allowed to remain unworked after the middle of July, these places usually produce an enormous number of large thistle plants. Many such fields were seen during the autumns of 1892 and

1893 which might have been plowed for \$5 or less, or even planted with a paying second crop, but instead were left to produce a crop of weeds, which might easily cause hundreds of dollars damage.

If summer fallowing is practiced, the land should be plowed late in the spring, so that seeds near the surface will have germinated and the young plants be killed. The harrow or cultivator should be kept in use during the summer. The thorough cultivation will improve the condition of the soil for future crops as well as keep the weeds from seeding. This is the theory of summer fallowing, but, unfortunately, it has seldom been fully carried out in the Dakotas and adjoining States. The land there has usually been left untouched after the spring plowing. Instead of a barren fallow or "resting period" a crop of weeds is grown, which drains the land almost as much as a crop of grain, and the soil, instead of being cleared of weeds, becomes a veritable hotbed of them. Summer fallowing, even if the land is kept barren by cultivation, gives comparatively little benefit except to clear out the weed seed. This object may be attained just as well by raising a crop which will pay the expenses of cultivation. Beans, pease, clover, millet, or rye may be sown, pastured, and plowed under for green fertilizer at little expense, and it will improve the land vastly more than barren fallowing. Millet and oats combined may be grown and cut for hay. This crop will choke out nearly all weeds, while the few that do grow will be slender and weak, producing comparatively few seeds, and many will be cut with the hay before producing any seed.

Roadsides, fire-breaks, and waste places.—If the Russian thistle is to be kept out of cultivated fields it must be exterminated on roadsides, fire-breaks, and waste land where the sod has been broken, and in all places where it has obtained foothold.

In many places the roads, which are usually mere unfenced drives across the prairie, are lined on each side by hedges of robust Russian thistles growing between the beaten track and the prairie grass, as ragweeds grow along roads in the East. A road machine may here be used to good advantage, the scraper being set so as to take as thin a layer of earth as possible, and weeds and all being thrown to the middle of the track. Fire-breaks can be kept free from the Russian thistle and other weeds most economically by frequent use of the harrow. When covered with large dry tumbleweeds, as they frequently are, instead of being a protection they become a source of great danger in times of prairie fires.

In the sand hills, on public lands, and in the scattered weed patches of cattle ranges there seems to be no direct compensation for the labor expended in exterminating the weeds. The thistles, however, must be destroyed in these places, and the work may be done at a cost small in comparison with the damage these plants would cause if allowed to produce seed.

The great windrows of Russian thistles found banked up against wire

fences in early winter suggest the use of fences to check the dissemination of the weed by rolling. The thistles, however, will easily bound over a fence, especially after the bank reaches its top; and at any time the whole pile is liable by a shift in the wind to be sent off in some other direction. Prompt burning would be of some value, and this would be possible if metallic fence posts were used.

POINTS OF INTRODUCTION TO BE GUARDED.

Like all noxious weeds the Russian thistle may be kept out much more easily than it can be eradicated when once established. In regions not yet infested all avenues of introduction should be watched so that it may be discovered and killed before it can obtain a footing.

It may be expected along all lines of railroads, especially those having direct traffic with infested regions. It is by way of the railroads that the seeds most often enter new territory, being dropped from stock or grain cars at stock yards, elevators, and sidings. The plants usually appear first close along the tracks by the ends of the ties, where the seed falling from the cars finds conditions favorable to growth in the unoccupied soil, kept stirred by repairs on the tracks and the ballast.

The seeds have been introduced in some cases in baled hay and grain at fair grounds, race tracks, lumber camps, and railroad construction camps. They have also been carried in shelled corn, wheat, oats, millet, flax, alfalfa, and grass seed. They are supposed to have been brought to some localities in Idaho in sheep's wool. While the seed has no hooks, barbs, or gum to cause it to stick like cockle-bur or clammy cuphea, its small size and light weight enable it to retain a place for some time in a fleece.

Another means of introduction and rapid distribution, and one that threatens to be most troublesome, is running water. During the past two years the thistle has spread with remarkable rapidity over irrigated lands in Colorado and Idaho. Robust plants are produced on the banks of the irrigating canals and ditches. The seeds from these are carried long distances by the water and deposited in the fields. In some cases quarter-sections of irrigated land have been practically covered with the Russian thistle in a single season. The plants have also spread along river banks, especially during freshets.

These sources of introduction should be carefully guarded, and every Russian thistle seen should be destroyed before it has produced seed. If any escape notice until the seeds are mature they should be cut and burned before they begin to roll. One Russian thistle destroyed this year is likely to obviate the necessity for destroying 1,000 to 100,000 next year.

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